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Types and forms of resilience in local planning in the U.S.: Who does what?

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ABSTRACT

This paper presents and analyzes the results of a survey of actors (n = 130) engaged in planning activities in local governments in the United States (U.S.). This exploratory survey was designed to evaluate the nature of existing resilience, climate change and multi-hazard planning activities, if any, as well as additional considerations for understanding the general state of awareness and knowledge of resilience activities and strategies among various public sector actors. The survey data tests several hypotheses, including the hypothesized disproportionate activity of large cities; the positive correlation between resilience, hazard mitigation and emergency planning; and, the dominate usage of disaster and engineering conceptual variants of resilience. Data from the survey provides evidence in support of an affirmation of the hypotheses. The paper offers insight into the dominate actors and frames that are driving resilience planning, as well as the challenges faced by a lack of discipline for applying categorical variants of resilience.

This paper presents and analyzes the results of a survey of actors (n = 130) engaged in planning and management activities in local governments from across the United States (U.S.). This exploratory survey was designed to evaluate the nature of existing resilience, climate change and multi-hazard planning activities, if any, as well as additional considerations for understanding the general state of awareness and knowledge of resilience activities and strategies among various public sector actors. The survey data tests several hypotheses relating to the state of resilience planning in local governments. The first hypothesis is that jurisdictions with large populations (n = 500,000+, "Large Cities") are more likely to be advancing resilience and climate change planning activities than cities of a lesser population ("Hypothesis A"). The second hypothesis is that resilience planning among all respondents is positively correlated with existing activities for emergency management planning and hazard mitigation planning ("Hypothesis B"). Finally, consistent with Hypothesis B, the third hypothesis is that a majority of respondents are framing resilience within a single-equilibrium understanding of resilience most closely aligned with the concepts of 'disaster' or 'engineering' resilience (Davidson et al., 2016; Meerow et al., 2016) ("Hypothesis C"). In addition to addressing these hypotheses, the survey was designed to offer insight into the sector specific focus of resilience planning, the general awareness and sourcing of resilience resources, and the extent to which there has been engagement with the resources and activities associated with the multi-agency federal initiative known as the U.S. Community Resilience Panel for Buildings and Infrastructure Systems.

While much scholarly attention has been focused on comparative or meta-analysis of resilience and climate change adaptation planning among local governments in Europe, Asia and Latin America (Anguelovski et al., 2016; Araos et al., 2016; Crowe et al., 2016; Mehmood, 2016; Suárez et al., 2016; Rudolf et al., 2017), it has only been in recent years that resilience and adaptation plans have been equallyevaluated in detail in the U.S. (Berke et al., 2014a, 2014b; Shi et al., 2015; Stults and Woodruff, 2016; Woodruff and Stults, 2016). However, these evaluations have almost exclusively focused on a textual analysis of existing plans and have not widely surveyed those actors who are engaged in the process of developing, executing or managing various plans. Globally, the varied application of various concepts of resilience (e.g., disaster, engineering, socioecological, et al.) by these actors have resulted in a patchwork for practices based on an equally diverse set of interpretations and motivations (Keenan et al., 2016; Béné et al., 2017). This article seeks to address this gap in the literature by assessing the human elements of the institutional capacities shaping a variety of planning processes among the sample local jurisdictions. With a better understanding of actor orientation, co-alignment of planning activities, and the relative capacity of various size jurisdictions, federal, state and civic sector leadership may be in a position to more accurately and effectively provide resources, promulgate policy directives and communicate management challenges and opportunities.

1. Resilience planning in local governments in the U.S

In recent years, studies have sought to provide insight into a broad

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spectrum of federal and local adaptation plans and their associated barriers for development and execution in the U.S. (Bierbaum et al., 2013). In general, the barriers have been consistent with what Moser and Ekstromoutlined nearly a decade ago, including a lack of skilled leadership and a lack of an agreed upon problem, approach and/or method (Moser and Ekstrom, 2010; Hamin et al., 2014; Hamina and Gurran, 2015). At best, many U.S. municipalities have been observed to be in either early scoping or planning exercises with few engaging in implementation (Shi et al., 2015).

A review of early stage literature has put forth four fundamental questions regarding local government adaptation planning. First, what is the influence of various federal policies in hazard mitigation and climate change on local planning decisions (Berke et al., 2014a, 2014b)? Second, does the size of local governments necessarily correlate with resource allocation for adaptation planning (Shi et al., 2016)? To this end, is it just large cities that have the expertise and can afford to engage in adaptation planning? Third, what are the implications of various stakeholders merging or conflating disaster risk reduction and its nearest cousins in disaster or engineering resilience with climate change adaptation frames (Keenan et al., 2016)? The literature has long acknowledged the necessity of adaptation to build upon the institutional capacities and knowledge of disaster risk reduction, but very little literature has evaluated the discontinuities or gaps that may result from such an alignment (Solecki et al., 2011).

Fourth, the literature has not identified who among various actors is at the helm of these efforts. Is it engineers who seek to apply single equilibrium engineering resilience of closed infrastructure systems, emergency managers who have followed emergent federal policies on matters of disaster resilience, urban planners who have tracked the emerging discourse in community or urban resilience, environmental policy experts who are building upon a legacy of multi-equilibrium ecological resilience, or, some combination of actors or frames (Meerow et al., 2016)? While it is likely that it is combination of actors and frames, there is no empirical understanding of what, if any, are the dominate frames, backgrounds and knowledge shaping emerging activities. As will be discussed, some emerging qualitative evidence suggests that emergency managers and engineers are having a disproportionate impact through the utilization of disaster and engineering resilience frames. While it is beyond the scope of this paper, it is assumed that the synergies and conflicts between the various concepts of resilience and adaptation are potentially problematic by virtue of a lack of a certain determinacy regarding legislative, design and communicative intent (Keenan, 2017). Collectively, these questions contextualized and informed the development of the hypotheses described in the following section.

2. Research design and methodology

The research design of this paper is centered on a survey containing sixteen (16) questions (Bickman and Rog, 2008; Groves et al., 2011). A copy of the survey instrument is contained in the Appendix. The survey design was developed in conjunction with the activities of the federal multi-agency panel operating as the U.S. Community Resilience Panel for Buildings and Infrastructure Systems ("CRP"). The survey design was evaluated subject to a peer review of participants from the CRP, U.S. Environmental Protection Agency (EPA), the National Institute of Standards and Technology (NIST) and the Public Technology Institute (collectively, the "Review Panel"). Pursuant to federal regulations, the survey instrument was issued by CRP and not any of its affiliated federal co-sponsors. As such, no federal agency has exercised oversight or editorial discretion over the collection or interpretation of the data in this paper.

However, the Review Panel participated in focus groups that edited and tested the survey questions. In addition, the Review Panel collected and organized the email data for approximately 300 persons within their network who together make up the total population of this survey. The survey was emailed with a link to the sample population and remained open online for a period of 120 days in the spring of 2017. The response rate was 43% (n = 130). There are several limitations to this sampling strategy. First, the sample population may be slightly biased toward those individuals and jurisdictions who are engaged in some measure of resilience planning by virtue of the network of the Review Panel. An additional potential selection bias may relate to those who answered the survey of behalf of their jurisdiction. It is possible that these respondents were internally selected to answer based on their recognized superior knowledge of resilience planning activities. Therefore, the representativeness of this sample cannot be warranted as a random sample. Second, the relatively low response rate can be partially attributable to skepticism and/or apathy of respondents to engaging what was perceived as a federal survey following the recent presidential transition.

The pathway of the survey was based on conditional responses, whereas, following an ascertainment of local planning exercises (e.g., land use, resilience, hazard mitigation, et al.) and corresponding hazards, those without knowledge of specific knowledge of resilience planning activities were directed to Question #15 regarding an open solicitation for a definition of resilience. Therefore, one portion of the survey data is from only those respondents (n = 83, 75%) who professed at least some familiarity with resilience planning in their respective jurisdictions, as per Question #6. All respondents were solicited on their knowledge of the CRP and whether they would like to be engaged with or in contact with the CRP. The quantitative results of the survey were analyzed using Excel and STATA software and were subject to linear regression (Bollen et al., 2016), propensity scoring (Schonlau et al., 2009) and factor analysis (Costello and Osborne, 2005). The latter two methods were utilized to explore various relationships not presented in this paper. Answers to Question #15 were subject to textual content analysis (Stemler, 2001) and were then classified into one or more of the several categories of community, disaster, ecological, engineering, socioecological and urban resilience (Davidson et al., 2016; Meerow et al., 2016). Finally, for multiple questions, some manually entered datum in the "other" categories were recategorized within the main categories presented in the questions.

The development of the hypotheses was based on qualitative case study spanning 27 months, derived from the activities of CRP that were varied in terms of geography within the U.S., federal and private sector participation, and hazard and sector specific exercises (Noor, 2008). The primary modes of data collection, including dozens of unstructured interviews (Rubin and Rubin, 2011) were from four national conferences, monthly conference calls and the archive of CRP containing meeting notes and presentation slides published on the CRP's website (Community Resilience Panel for Buildings and Infrastructure Systems (CRP, 2017). Consistent with the hypotheses, the local activities were found to be predominately driven by emergency management and/or various types of engineers operating in cities with relatively large populations. In addition, these activities were observed to be primarily integrated within existing hazard and emergency planning processes. There was no observed consistent use of a specific frame of resilience and/or adaptation. The aforementioned qualitative methods were likely insufficient to fully capture the data necessary to evaluate consistency and usage of the various concepts of resilience evaluated herein. However, given the alignment of resilience activities with disaster and engineering activities and/or actors, it was hypothesized that disaster and engineering categorical variants of resilience would be disproportionately represented among actors engaged in resilience activities.

3. Survey results

3.1. Geography and demographics

The survey was initiated by 130 respondents and was completed in its entirety by 63% (n = 82) of the respondents. The most frequently

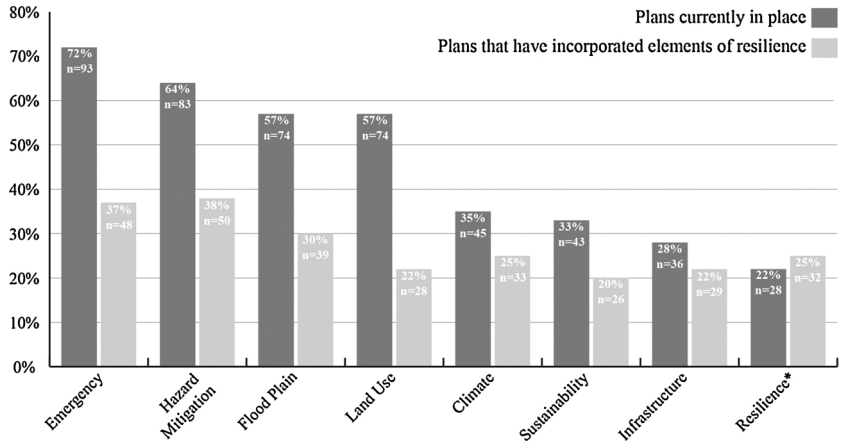

Fig. 1. Plans and Plans with Resilience Elements in Local Jurisdictions.

cited positions of the respondents were in emergency management (n = 30, 23%), city management (n = 20, 15%), and public works (n = 20, 15%). Only 9 (7%) of respondents worked in environmental units and only 11 (8%) respondents worked in city planning. Nearly a quarter (27%, n = 35) of respondents identified a variety of positions, including internet technology (IT) security, school administration, transportation engineering and elected office.

The respondents represented jurisdictions in 34 states and territories. The states with the top five most respondents were Florida (n = 14), California and Oregon (n = 12), Maryland (n = 10), and New York and Colorado (n = 8) and Virginia (n = 7). The most frequently represented states were all coastal states, with the exception of Colorado. Overall, coastal states represented just 54% (n = 18) of the represented jurisdictions. All of the represented states have been subject to a Presidential Disaster Declaration in the last five years. Large Cities with a population exceeding 500,000 ("Large Cities") were represented by 45% of respondents (n = 59). Jurisdictions with a population below 50,000 were represented in 18% of the responses (n = 24). Small cities (50,000–99,999) comprised 8% (n = 11), medium-sized cities (100,000–249,999) comprised 13% (n = 17) and second-tier cities (250,000–999,999) comprised 14% (n = 19) of the responses. Cities with a population exceeding 1 million comprised 31% (n = 40) of the sample. Although data was not collected on the precise identity of the respondents, the inference based on state and population data is that these several cities were often represented in the sample by more than one respondent. As such, based on IP addresses, the data was treated to minimize overrepresentation of any single jurisdiction.

3.2. Planning activities

Across all planning activities, a variety of hazards were considered. Natural hazards (e.g., hurricanes, earthquakes)(93%, n = 101) and technological hazards (chemical spills, power grid failure)(81%, n = 88) were the most frequently accounted for hazards. Public health hazards (e.g., vector borne diseases, food borne illness) (71%, n = 77), human-caused hazards (e.g., social unrest, terrorist attack)(n = 67%, n = 73) and cyber threats (47%, n = 51) were also widely reported. Climate change impacts (e.g., seal level rise, heat waves) were considered by 58% (n = 63) of respondents. Economic disruption was explicitly cited in just 4 (3.7%) responses.

Planning activities within these jurisdictions were varied with only 24% (n = 28) having a designated resilience plans compared with 39% (n = 45) and 38% (n = 43) having climate action or sustainability plan, respectively. However, 82% (n = 93) of jurisdictions had an emergency response plan and 73% (n = 83) had hazard mitigation plans. Other plans included flood plain management (n = 74, 65%), land use (n = 74, 65%), and infrastructure management (n = 37, 32%) plans.

Overall 76% (n = 82) of respondents were aware of some measure of resilience being advanced in their jurisdictions. As represented in Fig. 1, the degree of incorporation of resilience within existing plans varied by plan category. Respondents cited that the plans most frequently incorporating resilience were hazard mitigation (n = 50, 63%), emergency response (n = 48, 61%), and flood plain management (n = 39, 49%) plans. Climate action (n = 33, 42%) and sustainability (n = 26, 33%) plans were also cited for incorporating resilience. Land use (n = 28, 35%) and infrastructure management plans (n = 29, 37%) were less frequently cited for incorporation. The largest percentage gap between reported plans and plans that included resilience elements was land use with only 37% of plans incorporating resilience. The highest percentage of inclusion of resilience elements were climate plans (75%, n = 33) and infrastructure plans (81%, n = 29).

3.3. Sector specific focus

As represented in Fig. 2, dedicated free-standing resilience plans incorporated aspects of buildings and facilities (n = 22, 88%), transportation (n = 20, 80%), water and waste water (n = 19, 76%), communications (n = 18, 72%), social service (n = 17, 68%), energy (n = 16, 64%) and economy (n = 15, 60%). By sector, across all plan categories that incorporated resilience, buildings and facilities were addressed on average in 86% (n = 200) of the plans; water and waste water was addressed on average in 76% (n = 175) of the plans; and, transportation was addressed on average in 70% (n = 166) of the plans. The energy sector was most frequently addressed in climate action (87%, n = 21), resilience (64%, n = 16) and sustainability (82%, n = 18) plans and was addressed in just 52% (n = 12) of infrastructure management plans. On average, across all plans incorporating resilience, considerations relating to economy (48%, n = 105) and social service (48%, n = 115) were the least addressed sectors.

3.4. Resilience resources

In terms of the general awareness of respondents, 65% (n = 48) respondents were familiar with Community Resilience Guides (the "NIST Guides") that are published by NIST and which are the basis for framing many activities of the CRP. Yet, very few (n = 15, 31%) had utilized the NIST Guides to inform their planning processes. Overall, federal government resources had been utilized by 46 respondents (83%), with only 9 respondents (16%) not utilizing federal resources and no respondents (0%) reporting a lack of awareness of any federal resilience resources. Local governments (n = 56, 96%), professional organizations (n = 46, 84%), state governments (n = 45, 78%), private sector organizations (n = 44, 80%), non-profits (n = 42, 77%) and, higher education (n = 38, 70%) rounded out the balance of sources for

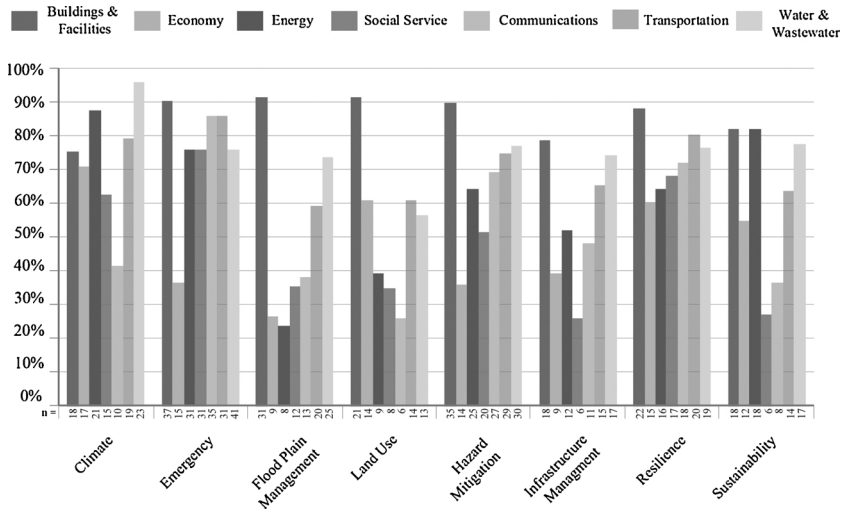

Fig. 2. Sector Coverage in Plans Incorporating Resilience Elements.

resources that were actually utilized for informing and shaping resilience planning. Of all cited sources of resources (n = 444), 375 (84%) were utilized to some extent in resilience planning. The greatest level of a lack of awareness was cited in resources coming from local governments (16%, n = 9), higher education (13%, n = 7), non-profits (13%, n = 7) and the private sector (11%, n = 6). Among all categories of resources, excluding the NIST Guides, respondents reported average utilization of 81%. Again, due to the conditional pathway of the survey, these questions were only answered by those respondents who had some familiarity with resilience planning in their local jurisdictions.

3.5. Variations of resilience

All respondents were solicited to independently provide a definition of resilience. They were not asked to provide a definition utilized by their local jurisdictions. Of the respondents, 71 (87%) were able to memorialize a definition and only 11 (13%) did not know a definition of resilience. The majority (n = 47, 66%) defined resilience in a manner consistent with a single-equilibrium conceptualization of resilience in that the capacities of resilience are understood to revert the host or system back to its relative domain of the status quo (Meerow et al., 2016). By application, single-equilibrium resilience is oriented to recovery and preservation following a disaster. A lesser number of the respondents (n = 23, 34%) conceptualized resilience within a multi-equilibrium conceptualization that acknowledges that a host's or system's resilience capacities are dynamic and that the host or system would otherwise have the potential for multiple stable states (Davidson et al., 2016). By application, multi-equilibrium resilience acknowledges that ongoing stresses and shocks may lead to an entirely different future stable state. In this sense, multi-equilibrium resilience is a bridging concept to transformational adaptation (Hill, 2016).

Consistent with the results for the incorporation of resilience in hazard and emergency planning, respondent's definitions most closely aligned with disaster (43%, n = 31), community (42%, n = 30) and engineering (35%, n = 25) resilience concepts. While only a few of the respondents' definitions for disaster (n = 5, 16%) and engineering (n = 7, 28%) were consistent with a multi-equilibrium understanding, most disaster (n = 2684%) and engineering (n = 18, 72%) definitions were consistent with a single equilibrium conceptualization, which is consistent with the broader literature on the conceptual categories of resilience. However, respondents' definitions that aligned with community resilience were closely split between single (n = 16, 53%) and multi-equilibrium (n = 14, 47%) conceptualizations. Overall, a comparatively smaller number of respondents' definitions were categorized as urban (11%, n = 8), socioecological (9%, n = 7) or ecological (7%, n = 5). It should be noted that sum of categorical observations exceeds the number of respondents for this question because many definitions contained elements that qualified for assignment to one or more categories.

4. Analysis and discussion

4.1. Geography and demographics

Tables 1,3–5 provide a variety of statistical analyses for the utilization of variable plans, including climate (*planclimate*), emergency management (*planemerg*), flood (*planflood*), land use (*planland*), hazard mitigation (*planhazard*), infrastructure management (*planinfra*), resilience (*planres*) and sustainability (*plansustain*) plans. Consistent with an affirmation of Hypothesis A, the results support the hypothesis that Large Cities are more focused on resilience planning efforts than jurisdictions with lower populations in the sample. The logic behind this hypothesis is that Large Cities have more at stake in terms of aggregate vulnerabilities and they also arguably have greater resources and levels of expertise to address more hazards, including those hazards associated with climate change impacts. As represented in Table 1, Large Cities have positive correlations for completing all plans, except for land use plans and infrastructure management plans. This is slightly surprising considering that Large Cities have more aggregate amounts of infrastructure that would otherwise necessitate specialized planning. However, this finding could be partially explained by the fact that special purpose extra-municipal administrative units, such as port authorities and airport authorities, are often responsible for managing infrastructure.

As represented in Table 2, Large Cities tend to consider more hazards, including natural hazards (*haznatural*) and climate change impacts (*hazclimate*), in their planning processes. Additional variable hazards include, technology (*haztech*), human (*hazhuman*), public health (*hazpubhealth*) and cyber (*hazcyber*) hazards. This is consistent with the logic of Hypothesis A in that Large Cities simply have greater resources to cover more hazards across a greater diversity of vulnerabilities and corresponding hazards. For instance, the findings also show a near equal correlation with public health hazards, which are more acutely problematic in cities with higher population densities where the risk of disease transmission is greater. It can also be argued that cities also represent a greater diversity of opinions as to the nature of hazards and how to respond. In theory, one might anticipate a positive correlation with Large Cities and multi-equilibrium definitions of resilience because the diversity of opinions about post-event response to a hazard would suggest a realization of multiple stable stages. However, there

Table 1
Correlations between Large Cities and All Planning Activities.

VARIABLES	(1) planclimate	(2) planemerg	(3) planflood	(4) planland	(5) planhazard	(6) planinfra	(7) planres	(8) plansustain
largcity	0.266***	0.180**	0.168*	−0.0492	0.259***	0.0516	0.226***	0.263***
	−0.0825	−0.077	−0.0862	−0.0879	−0.0808	−0.0797	−0.0727	−0.0817
Constant	0.225***	0.634***	0.493***	0.592***	0.521***	0.254***	0.113***	0.211***
	−0.05	−0.0576	−0.0598	−0.0588	−0.0597	−0.052	−0.0378	−0.0488
Observations	130	130	130	130	130	130	130	130
R-squared	0.078	0.039	0.029	0.002	0.072	0.003	0.075	0.078

Robust standard errors in parentheses.
*p < 0.1.
**p < 0.05.
***p < 0.01.

Table 2
Correlations between Large Cities and All Hazard Categories.

VARIABLES	(1) haznatural	(2) haztech	(3) hazhuman	(4) hazpubhealth	(5) hazclimate	(6) hazcyber
largecity	0.143**	0.095	0.182**	0.219**	0.385***	0.244***
	−0.0721	−0.082	−0.0862	−0.0843	−0.0819	−0.0848
Constant	0.704***	0.634***	0.479***	0.493***	0.310***	0.282***
	−0.0546	−0.0576	−0.0597	−0.0598	−0.0553	−0.0538
Observations	130	130	130	130	130	130
R-squared	0.029	0.01	0.033	0.049	0.147	0.062

Robust standard errors in parentheses.
*p < 0.1.
**p < 0.05.
***p < 0.01.

Table 3
Correlations between Emergency Planning and All Planning Activities.

VARIABLES	(1) planclimate	(2) planflood	(3) planland	(4) planhazard	(5) planinfra	(6) planres	(7) plansustain
planemerg	0.257***	0.531***	0.493***	0.741***	0.312***	0.226***	0.273***
	−0.0799	−0.0801	−0.0831	−0.0636	−0.0627	−0.06	−0.0765
Constant	0.162***	0.189***	0.216***	0.108**	0.0541	0.0541	0.135**
	−0.0611	−0.0649	−0.0682	−0.0514	−0.0375	−0.0375	−0.0566
Observations	130	130	130	130	130	130	130
R-squared	0.06	0.234	0.202	0.485	0.099	0.061	0.069

Robust standard errors in parentheses.
*p < 0.1.
**p < 0.05.
***p < 0.01.

Table 4
Correlations between Hazard Planning and All Planning Activities.

VARIABLES	(1) planclimate	(2) planemerg	(3) planflood	(4) planland	(5) planinfra	(6) planres	(7) plansustain
planhazard	0.309***	0.654***	0.558***	0.392***	0.234***	0.237***	0.251***
	−0.076	−0.0713	−0.076	−0.0849	−0.0723	−0.0622	−0.0777
Constant	0.149***	0.298***	0.213***	0.319***	0.128**	0.0638*	0.170***
	−0.0523	−0.0672	−0.0602	−0.0685	−0.0491	−0.0359	−0.0552
Observations	130	130	130	130	130	130	130
R-squared	0.097	0.485	0.293	0.144	0.063	0.077	0.066

Robust standard errors in parentheses.
*p < 0.1.
**p < 0.05.
***p < 0.01.

Table 5
Correlation between Resilience Planning and All Planning Activities.

VARIABLES	(1) planclimate	(2) planemerg	(3) planflood	(4) planland	(5) planhazard	(6) planinfra	(7) plansustain
planres	0.378***	0.272***	0.321***	0.0483	0.324***	0.375***	0.534***
	−0.101	−0.0682	−0.0884	−0.105	−0.0769	−0.102	−0.0921
Constant	0.265***	0.657***	0.500***	0.559***	0.569***	0.196***	0.216***
	−0.044	−0.0474	−0.0499	−0.0495	−0.0494	−0.0396	−0.041
Observations	130	130	130	130	130	130	130
R-squared	0.107	0.061	0.071	0.002	0.077	0.119	0.218

Robust standard errors in parentheses.
*p < 0.1.
**p < 0.05.
***p < 0.01.

was no statistically signification relationship found in the data. This may prove to be a source of valuable research in the future.

4.2. Planning activities

By the descriptive statistics, resilience planning is not occurring at the same frequency as are climate and sustainability plans. This can be partially explained by the fact that sustainability and climate mitigation efforts have at least a two decade head start compared with the relatively recent developments of resilience and climate adaptation planning. In fact, as represented in Fig. 1, not all climate plans include elements of resilience.

Consistent with an affirmation of Hypothesis B, there exists positive correlations between emergency and hazards plans and resilience plans. In fact, the strongest correlations were by and between emergency and hazard plans themselves. As represented in Tables 3 and 4, emergency and hazards plans are positively correlated with all other planning categories. While these findings are conceptually consistent as it relates to the resilience and climate planning, the explanation for with a correlation with sustainability planning are less obvious. One potential explanation relates a greater degree of environmental awareness by those who are subject to natural hazards (Tidball, 2012).

Consistent with Table 5, when looking at correlations between resilience planning and other planning categories, resilience planning has a positive correlation with all other categories except for land use planning. Again, land use planning—like environmental actors—was observed to be infrequently represented among the respondents (i.e., urban planners). Consistent with Fig. 1, this is potentially problematic considering that land use planning is widely considered to be one of the most efficient and effective tools for resilience and adaptation planning (Berke and Stevens, 2016; Butler et al., 2016). Likewise, the correlations between resilience and climate planning are not as strong as one would anticipate. The implication could be that climate plans are primarily conceptualized or are, in fact, focused on climate change mitigation.

4.3. Multi-Actor capacities

The survey data suggests that respondents are a diverse group in terms of their actor orientation and general understanding of resilience. However, consistent with the assumptions framings Hypotheses B and C, a significant cohort of actors (n = 55, 42%) are coming from emergency management and engineering based units, as it is assumed that engineers are disproportionately represented in public works and hazard planning administrative units. By contrast, environmental (n = 9, 7%) and urban planning actors (n = 11, 8%) are comparatively underrepresented in this sample, which is consistent with the evidence collected in the hypothesis development stage. However, the respondents represent a diverse set of actors with 63 different—but often related—vocations listed among the respondents. As a general proposition, the respondents were aware of a vast array of resources, in the public, private and civic sectors. A total lack of awareness in any given category of resources was registered by only 11% (n = 52) of respondents on average. By contrast, the average utilization in any given category of resources, excluding the NIST Guides, was relatively high (81%).

There appears to be a potential gap in identifying and applying resources from other governments and higher education with 51% (n = 30) of respondents either not utilizing or not being aware of resources from these sources. While many networks have sought to develop local-to-local connections, these findings further question the effectiveness of these efforts. Specific to resource from higher education, the challenge likely continues to be the translation of empirical scientific methodologies and findings to decision making process where the determination of risk thresholds is an ambient political decision (Vogel et al., 2007; Parris et al., 2016). Data from the hypothesis development stage suggested that such efforts have not been sufficiently tailored to specific sectors, actors and categories of resilience actions, strategies and beneficiaries. For instance, the looseness of defining 'community' in community resilience has led to a type of social dissonance with emergency management and engineering constituencies who seek greater resolution in the identification of objects of resilience and other closed systems with verifiable inputs and outputs (Aldrich, 2017). Social systems do not offer such certainty. In many ways, this dissonance is captured as a proxy in the respondents' understanding of resilience as a single versus multi-equilibrium set of processes.

Specific to Hypothesis C, the data confirms the hypothesis with 78% (n = 56) of respondents' definitions being consistent with either disaster or engineering resilience. There were several other important findings relating to respondent's conceptualization of resilience. First, consistent with the findings for limited participation among environmental and urban planning actors, ecological and socioecological resilience frames were observed to be limited in number. The implication is that the predominate object or beneficiary of resilience processes is either physical infrastructure or social organizations of an irresolute definition (e.g., communities). The environmental aspects of certain categories of resilience (e.g., ecological and socioecological) did not meaningfully register in the textual analysis. This is arguably a shortsighted understanding of resilience and highlights the value inherent in the conventional frames of transitional and transformative adaptation that are often more focused on incorporating environmental considerations within ecological and/or socioecological systems (Ahern, 2013; Ahern et al., 2014; Keenan, 2017).

Second, even among those who were focused on people as the primarily beneficiary of resilience—as opposed to ecological systems, for instance—there was a measurable divide between conceptualizing community resilience as either single (n = 16, 53%) or multi-equilibrium (n = 14, 46%) in its orientation. As the literature notes, later stage development of resilience across a variety of categories has acknowledged the value, if not necessity, of transformation—a concept

most closely aligned with adaptation (*see* Fig. 1 and Table 1, Davidson et al., 2016). Previous research has shown that U.S. actors engaged in climate change and disaster planning have utilized the language of single equilibrium resilience (i.e., disaster, engineering, etc…), but the meanings and applications of their frames were often more consistent with multi-equilibrium adaptation (Keenan et al., 2016). Again, these findings reinforce the proposition that the multitude of meanings based on a variety of categories of resilience stands to be a significant limitation for advancing more resolute legislative, design and communicative intent (Pizzo, 2015; Herrera, 2017). Future research is tasked to develop and apply clearer boundaries for the various categories of resilience and to explore the extent to which such categories are useful or effective relative to the intent or adaptive capacity of the associated parties.

5. Conclusions

The findings of this paper support an affirmation of all three hypotheses. At least among the respondents, Large Cities appear to be more engaged in resilience planning, which is consistent with the logic of having greater resources and greater vulnerabilities to a greater diversity of hazards. In addition, there are positive correlations between emergency, hazard and resilience planning. In complementary terms, emergency managers and engineers made up the largest cohort of respondents. Finally, there is consistent evidence that the respondents are primarily framing resilience within the single equilibrium framings of disaster and/or engineering resilience. Together, these findings shed light on not only current activities but also the capacities of those who are engaged with advancing resilience planning activities.

Additional research is challenged to provide a better understanding of the interaction between various planning processes. These interactions may shed light on potential resource sharing, comprehensiveness, and barriers to execution. Consistent with the previously cited literature, this paper provides evidence that actors are utilizing a variety of different definitions of resilience under a variety of different frames. Future research is tasked with evaluating existing processes to uncover the extent to which complimentary and conflicting frames of resilience are interacting within practice. Providing clarity between various categories of resilience, as well as the counterpoints of transformative adaptation, are likely key for effective future planning exercises. When one speaks of the analysis associated with single equilibrium engineering resilience within the context of a diverse social community with multiple stable states, the dissonance is arguably counter-productive. This paper provides evidence that this disconnect is likely occurring. To remedy problems such as this, greater discipline needs to be applied to not only the categorical usage of resilience frames, but also the identification of the object and beneficiary of resilience processes (Cutter, 2016; Meerow and Newell, 2016).

The findings of this paper provide partial evidence for a broader assertion about the nature of resilience leadership in the U.S. There are arguably several notable advantages and disadvantages to emergency managers and engineers leading the nation's resilience efforts. The advantages are shaped by empirical precision in the efficient allocation of resources. The disadvantages are an inability to fully capture social and environmental attributes of complex open systems that defy efficient optimization. The existing and future challenges associated with extreme weather and climate change are so great that it will require a wide variety of actors from the public, private and civic actors. The diversity of respondents in this paper demonstrate the tremendous strides made in this direction. However, to fully engage a broader spectrum of actors, precision in the actions, tactics, strategies and methodologies associated with resilience must be subject to accessible and universal translation across the various categories of resilience. Therefore, it can be argued that the frames associated with disaster and engineering categories are inherently limited. Not only are complex systems capable of multiple stable states, it is often desirable or otherwise necessary to transform to alternative states given the maladaptive nature of prevailing pathways.

In more immediate terms, the findings of this paper highlight some potential critical challenges within existing processes. Specific to urban planning and public administration, land use planning is widely considered to be a critical and cost-effective mechanism to address climate change (Hurlimann and March, 2012). Yet, this paper shows no correlations between land use and resilience planning; limited incorporation of resilience elements into land use plans; limited participation among urban planners; and, extremely limited usage of urban resilience as a frame. Are urban planners caught between the inherently conflicting ambitions of engineering resilience and community resilience? Has urban resilience moved too quickly or too slowly to align with forces driving transformative adaptation? The spectrum of urban and land use planners is diverse. Future research is additionally tasked to understand how these varied professional specializations are shaping and/or are being shaped by internal and external influences. Whether it is the emergence of professional education or the memorialization of best practices, little research is available to guide the pedagogical ambitions of the profession.

Developing some form of resilience and promoting some form of transformative adaptation in local governments is arguably going to require a diverse set of public, private and civic actors. The pathways that local governments develop today are likely to have impacts on the range of options and number of resources that can be mobilized to fulfil the future ambitions of local political institutions. If federal governments seek to facilitate the capacities of local governments to undertake resilience, multi-hazard and climate change planning activities, it is incumbent on the facilitators to understand the factors that are shaping existing practices. A failure to do so may result in miscommunication and a misallocation of resources. This paper offers modest evidence that begins to shed light on existing planning activities and multi-actor capacities. As local governments move forward, they will be increasingly challenged to diversify the objects and beneficiaries of resilience and adaptation. Without a more resolute understanding of the true nature of their intent or their capacities, local governments run the risk of flying blind.

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